

# **The Community Climate System Model and Ice Sheets**

**Peter Gent**

**Chairman**

**CCSM Scientific Steering Committee**

# Evolution of the CCSM

**J. Climate, 1998  
(Boville and Gent, 1998)**

**CSM 1.0**

**June 1996**

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**New ocean, land, sea-ice models  
New physics in atmospheric model**



**Kiehl and Gent, 2004**

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**May 2002**

**New physics in all components**

**J. Climate, 2006  
(Collins et al., 2006)  
IJHPCA, 2005**

**CCSM 3.0**

**June 2004**



- **26 papers**

- SSC (1)
- Atmosphere Model (6)
- Ocean Model (4)
- Land Model (2)
- Climate Change (2)
- Climate Variability (4)
- Polar Climate(4)
- Paleoclimate (3)

- **510 pages**

- **Authorship**

- 51 NCAR
- 48 External

## **J. Climate Special Issue devoted to CCSM3: Vol 19, No 11, June 1, 2006**



# The International Journal of High Performance Computing Applications

- **Objectives**

- Describe Software Engineering for climate models
- Document performance and portability

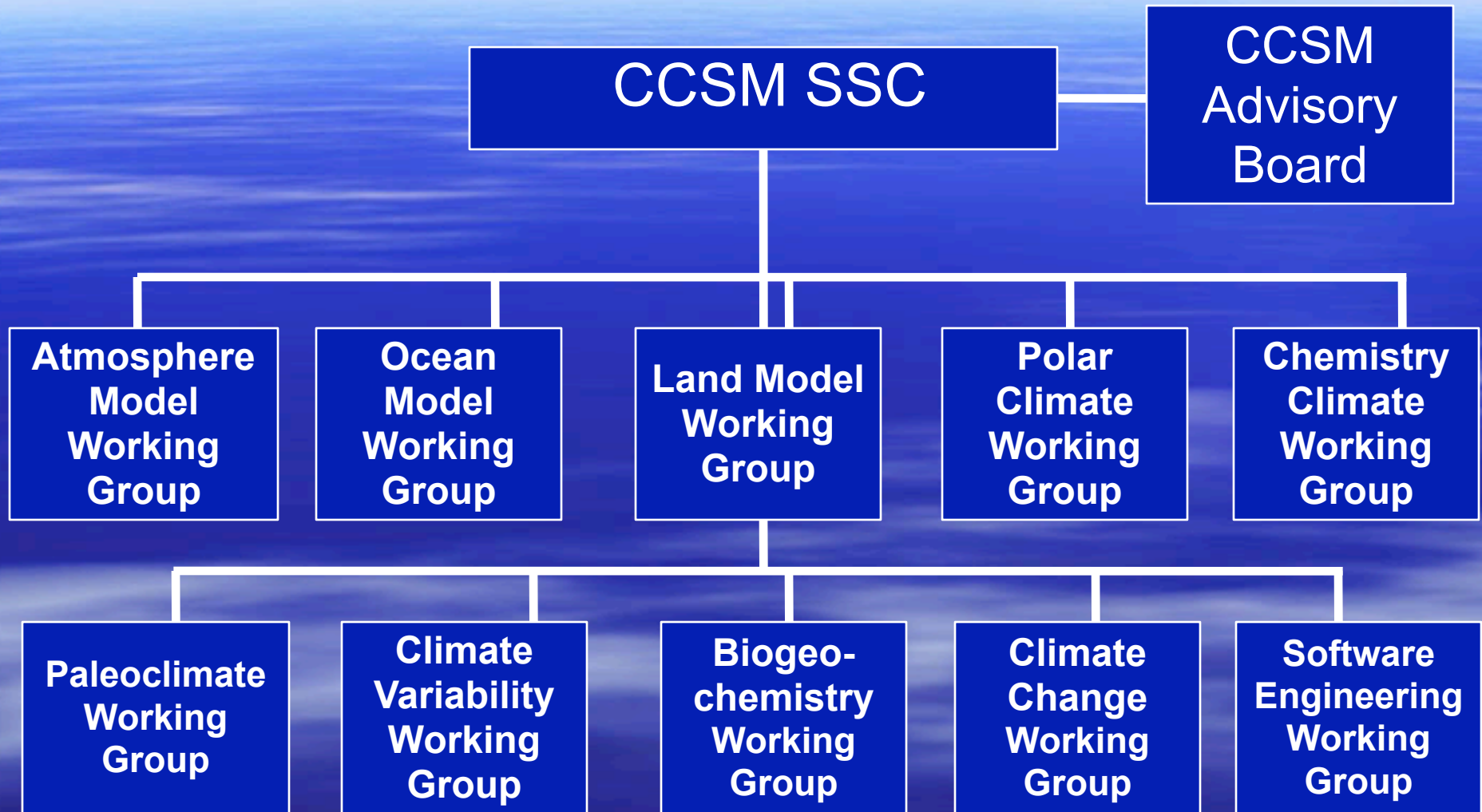
- **13 papers published in Fall 2005, Volume 19, Number 3**

- **Authorship**

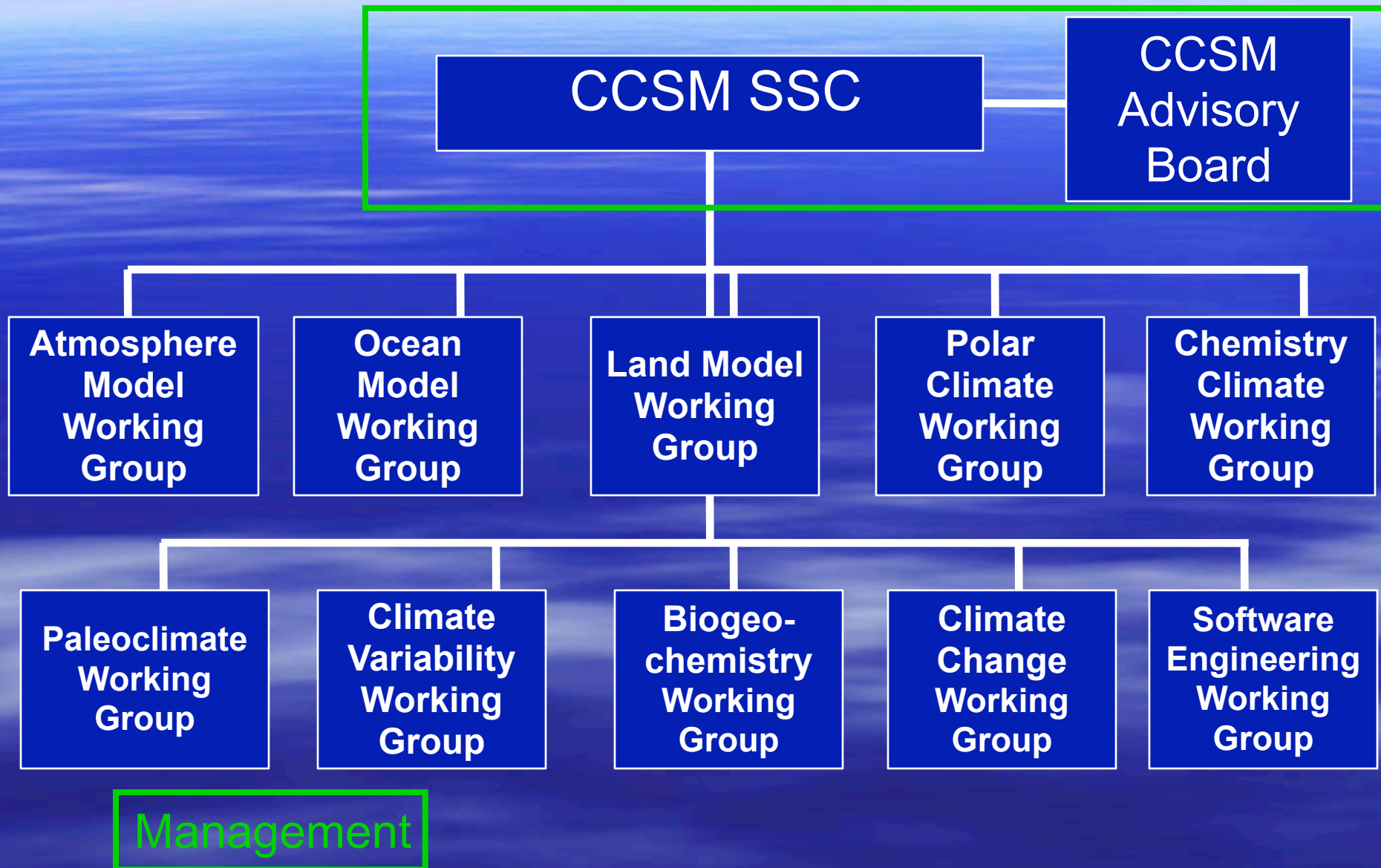
- 32 External
- 9 NCAR



# Organization of the CCSM Project

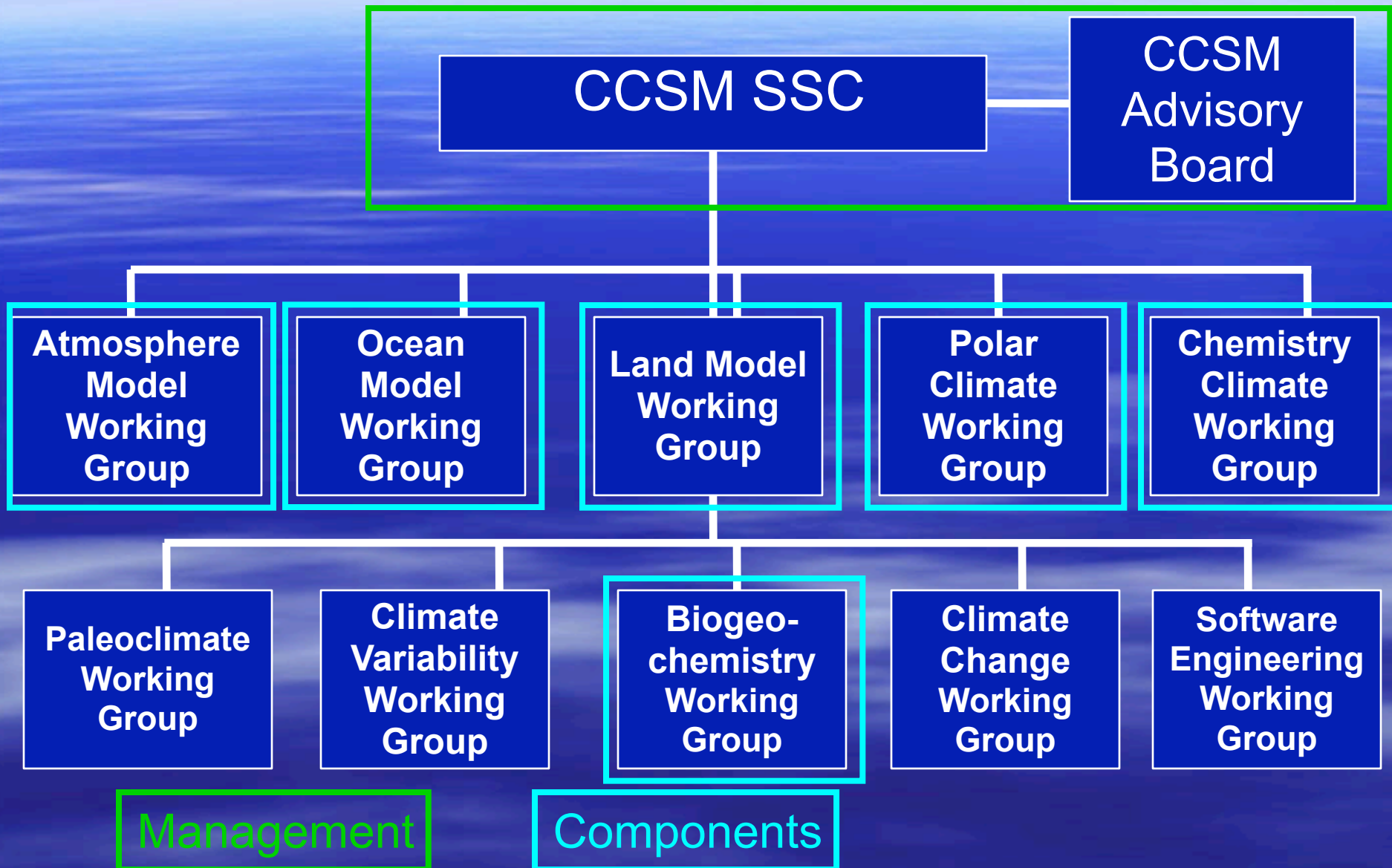


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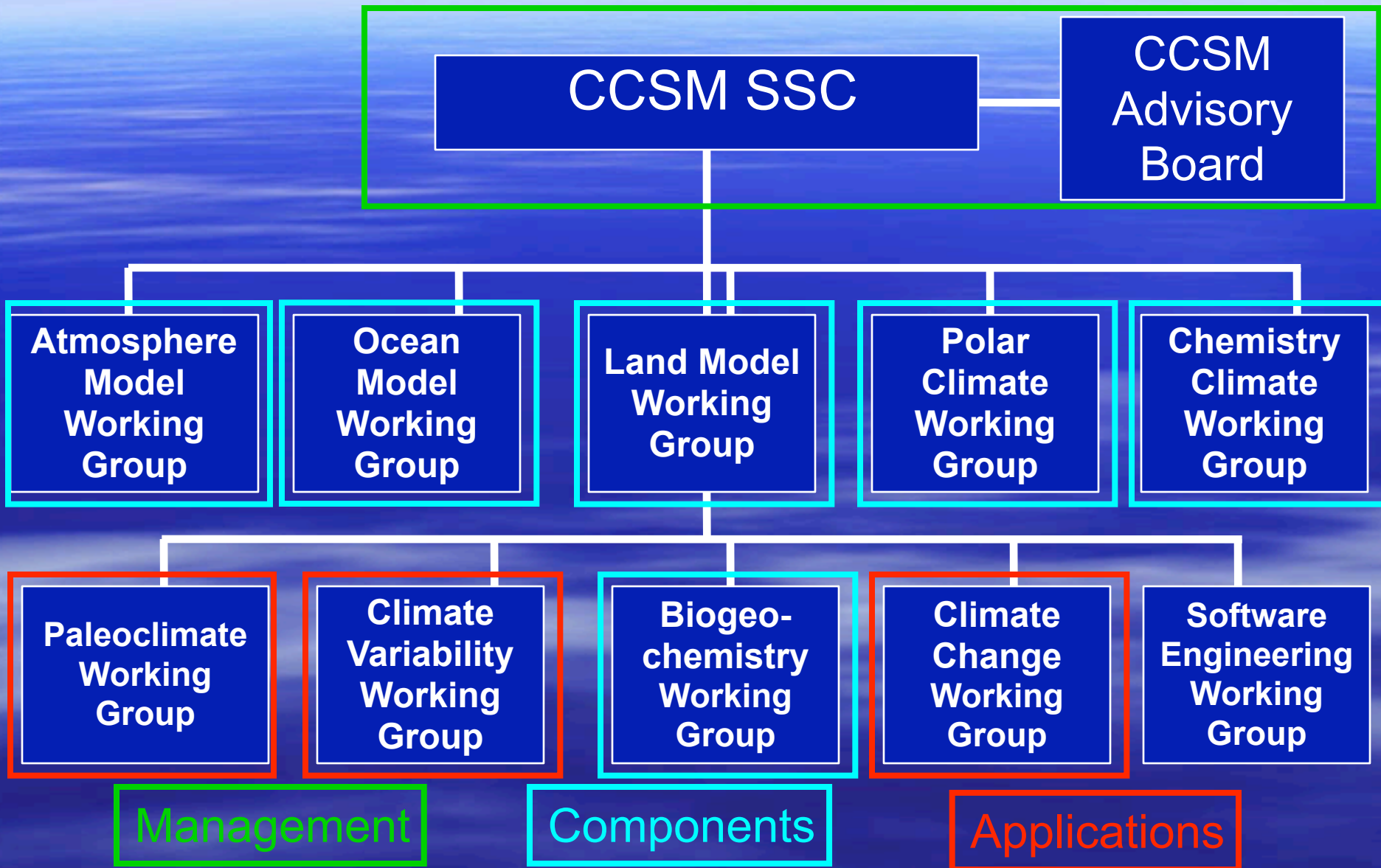




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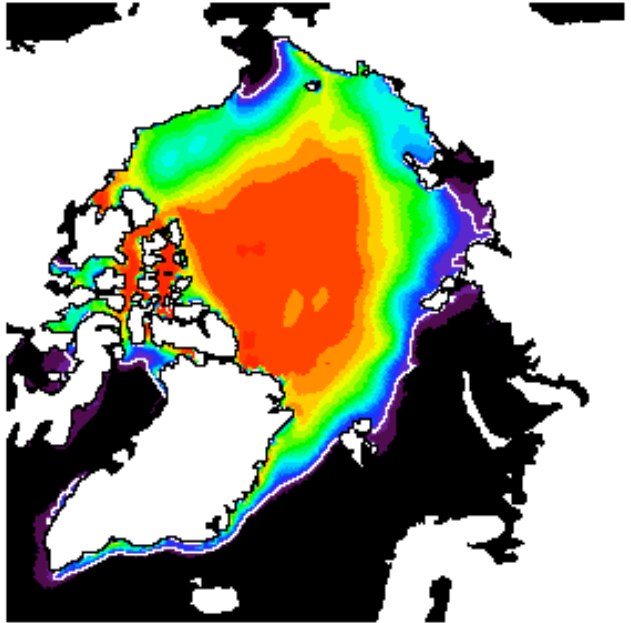


# Management of the CCSM Project

- Run by the Scientific Steering Committee, which has 12 members, 6 from NCAR and 6 from Universities and DOE laboratories.
- Currently there are 11 Working Groups, each with an internal and external cochair.
- The new WG started at the 2008 CCSM Workshop was the Whole Atmosphere Community Climate Model (WACCM).

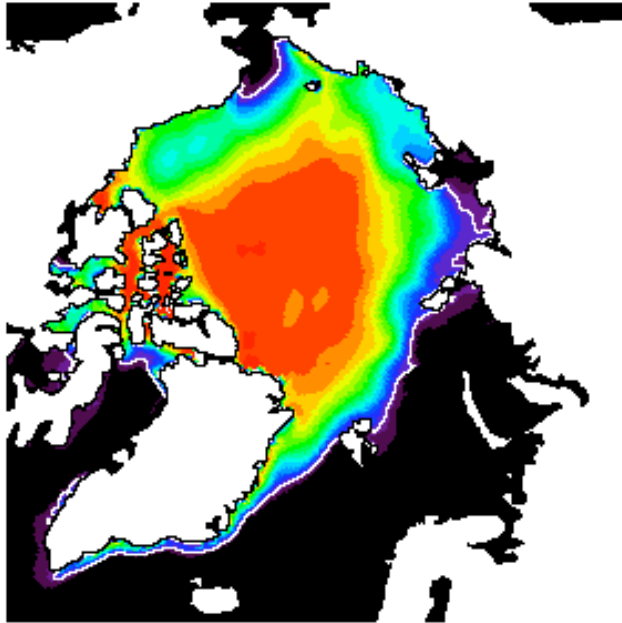
# *Arctic Sea Ice Concentration*

1990–1999 Avg SEPT aice

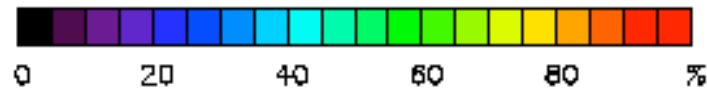
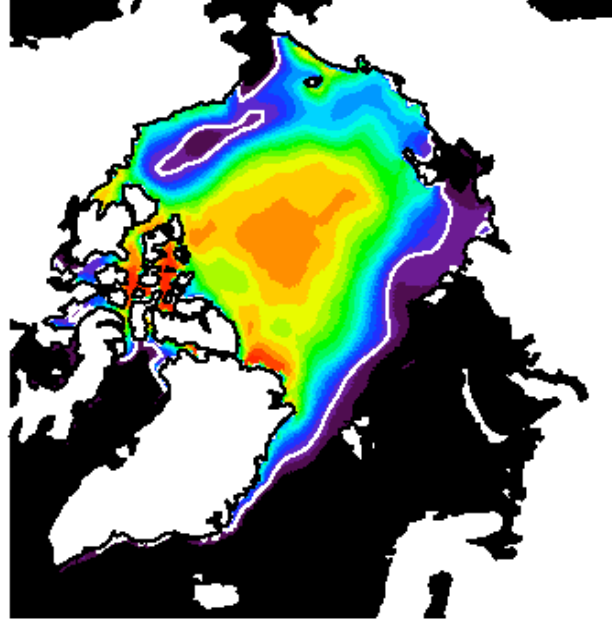


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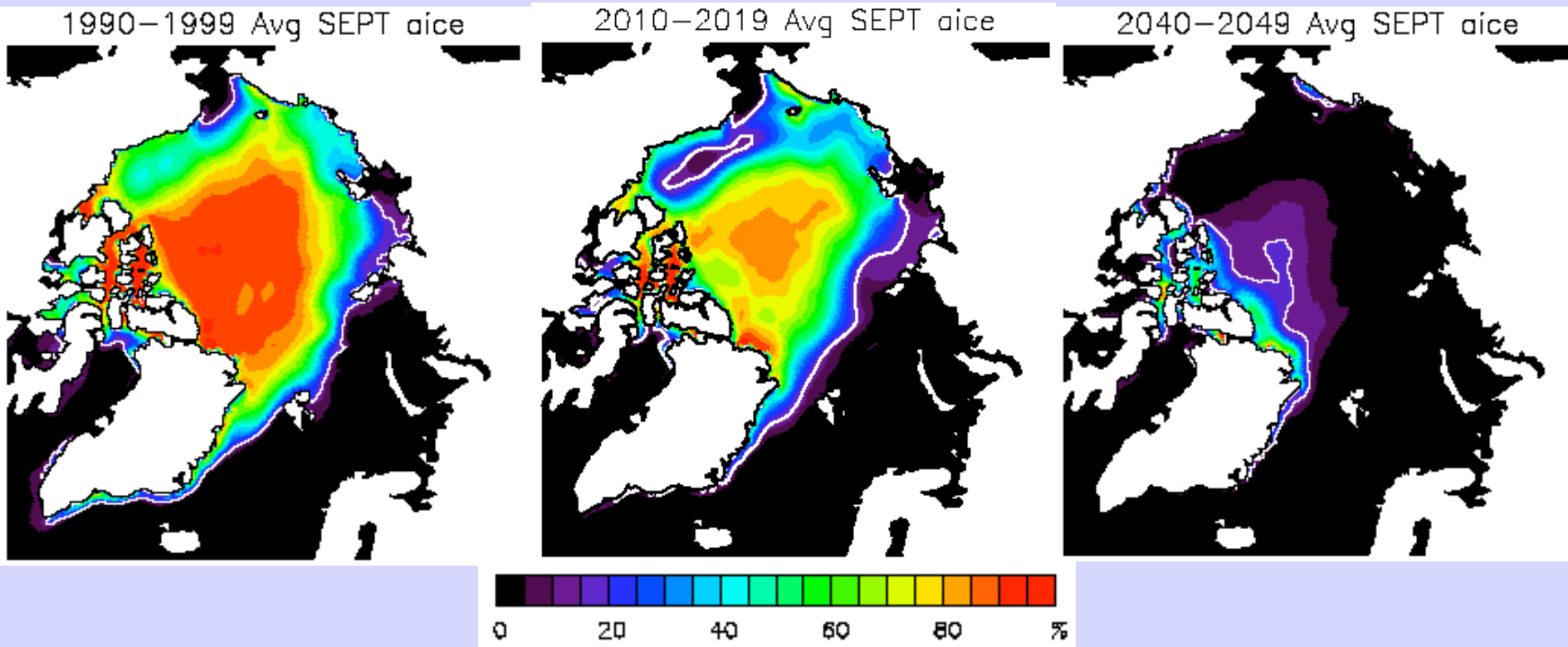
1990–1999 Avg SEPT aice



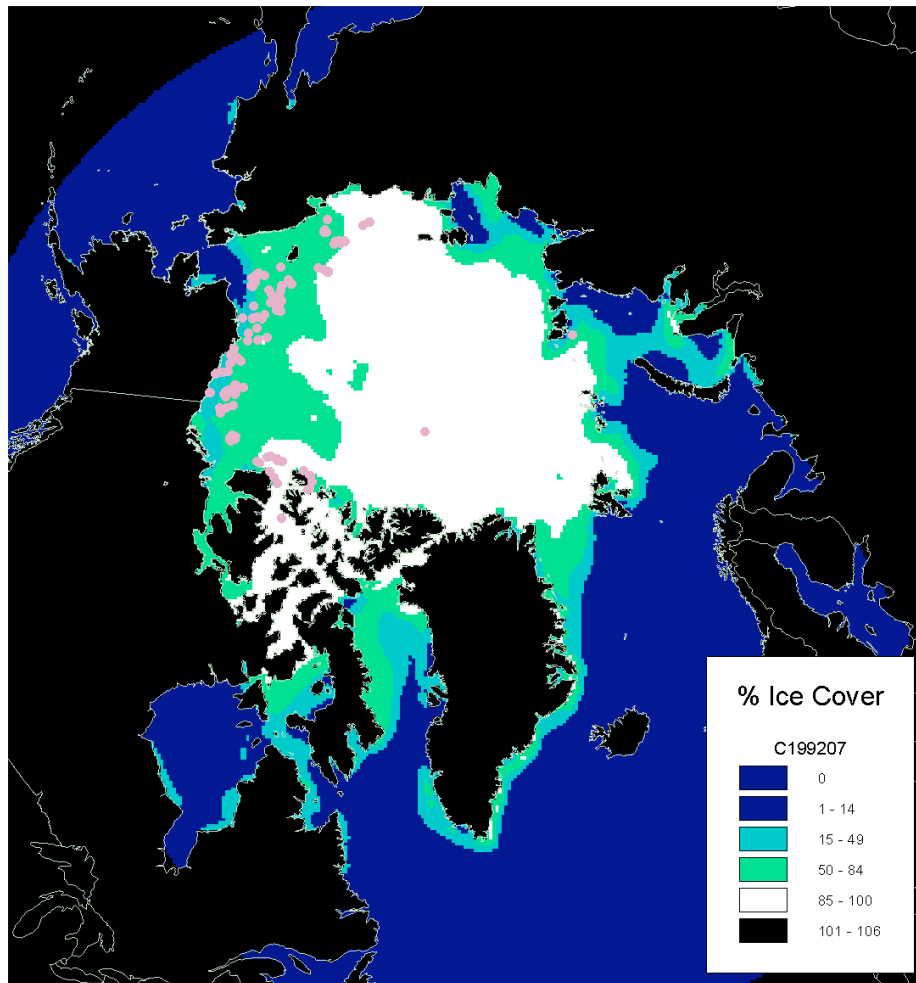
2010–2019 Avg SEPT aice



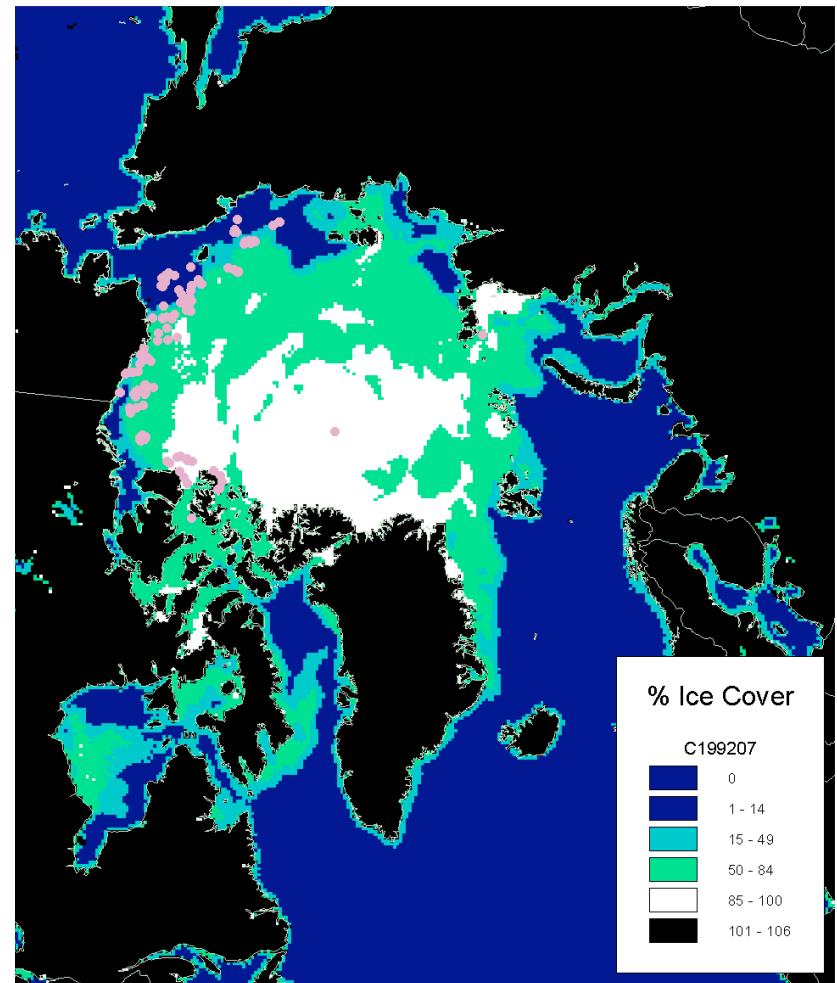
# *Arctic Sea Ice Concentration*



**September is mostly ice free by 2050 for A1B scenario**



CCSM3 – Fully Coupled  
July 1992

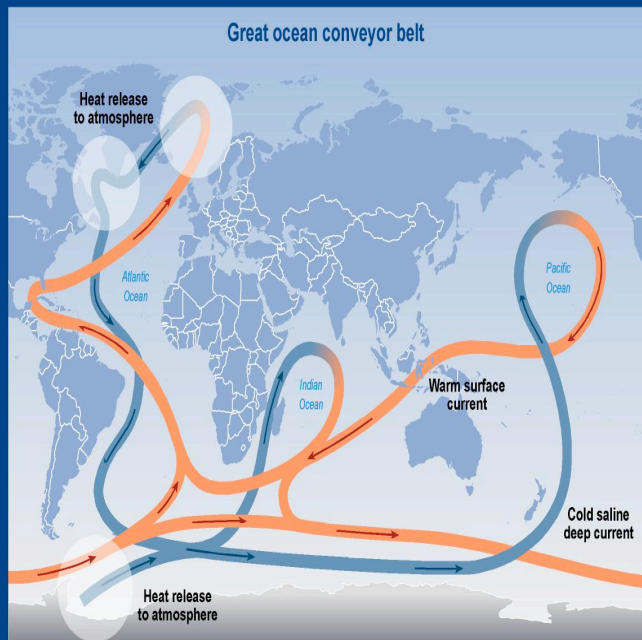


NASATeam SSM/I  
July 31, 1992

Polar Bear Locations: July 20-30, 1992



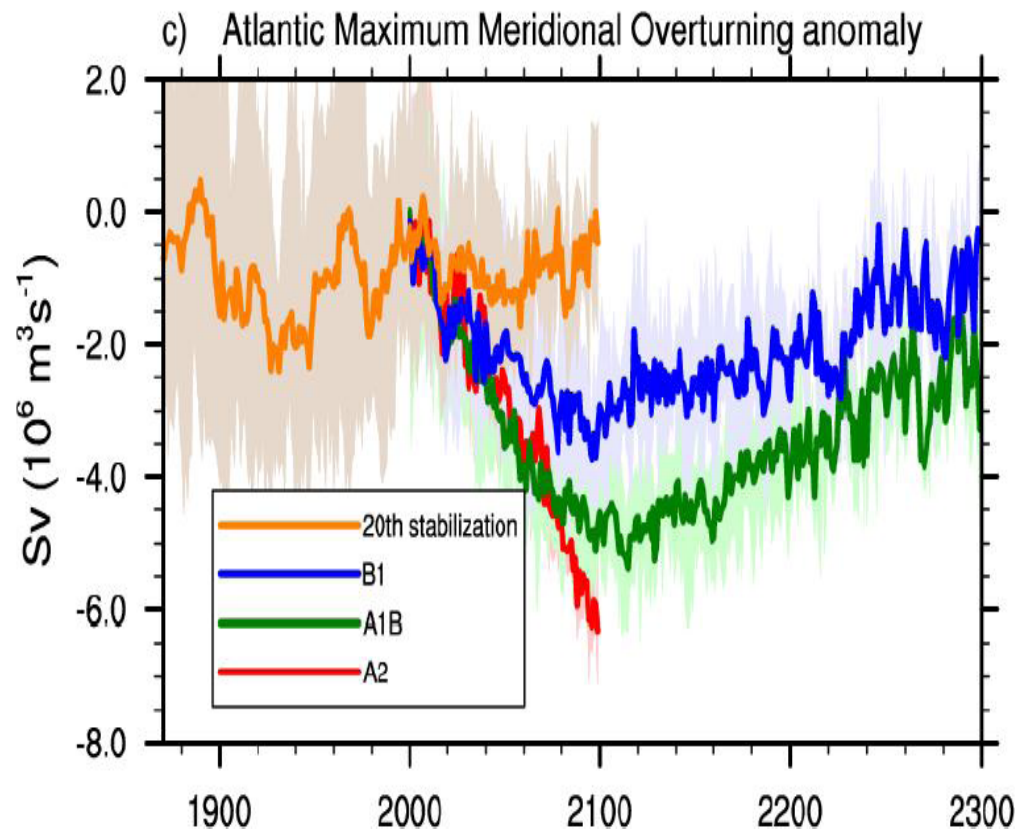
# *Future Projections of the North Atlantic Overturning Circulation*



SYR - FIGURE 4.2

IPCC

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

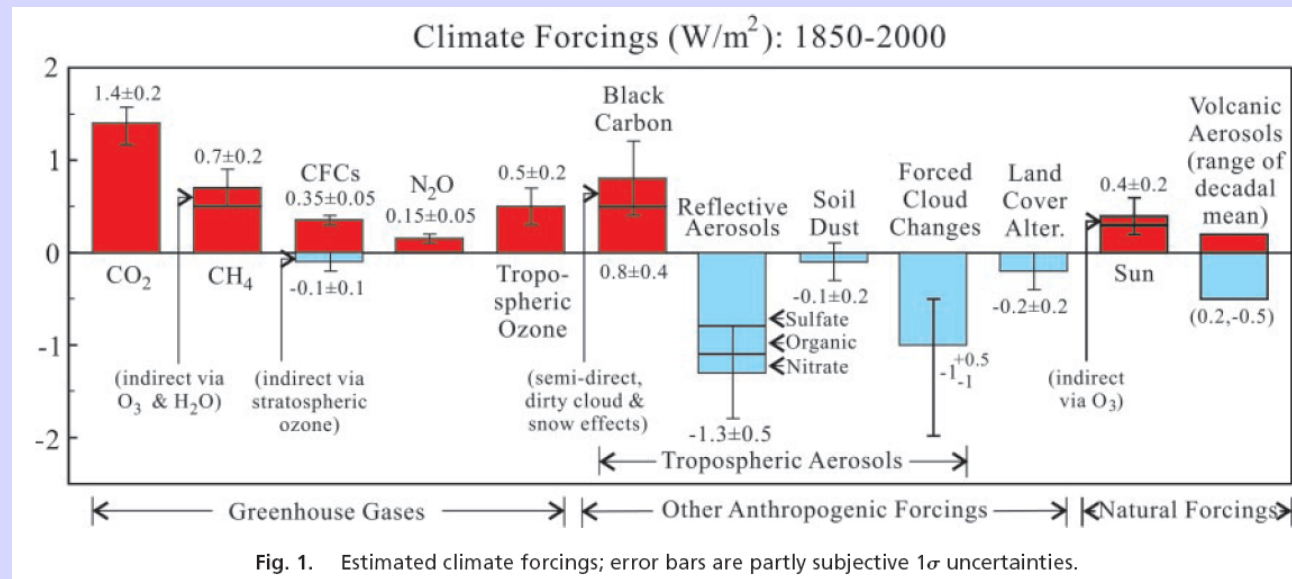
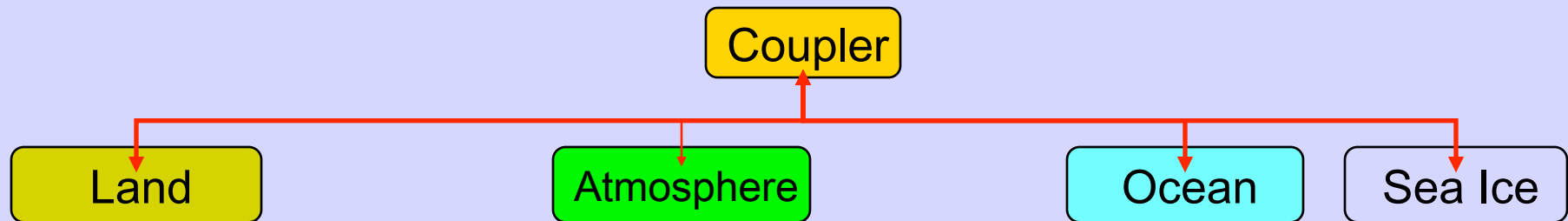




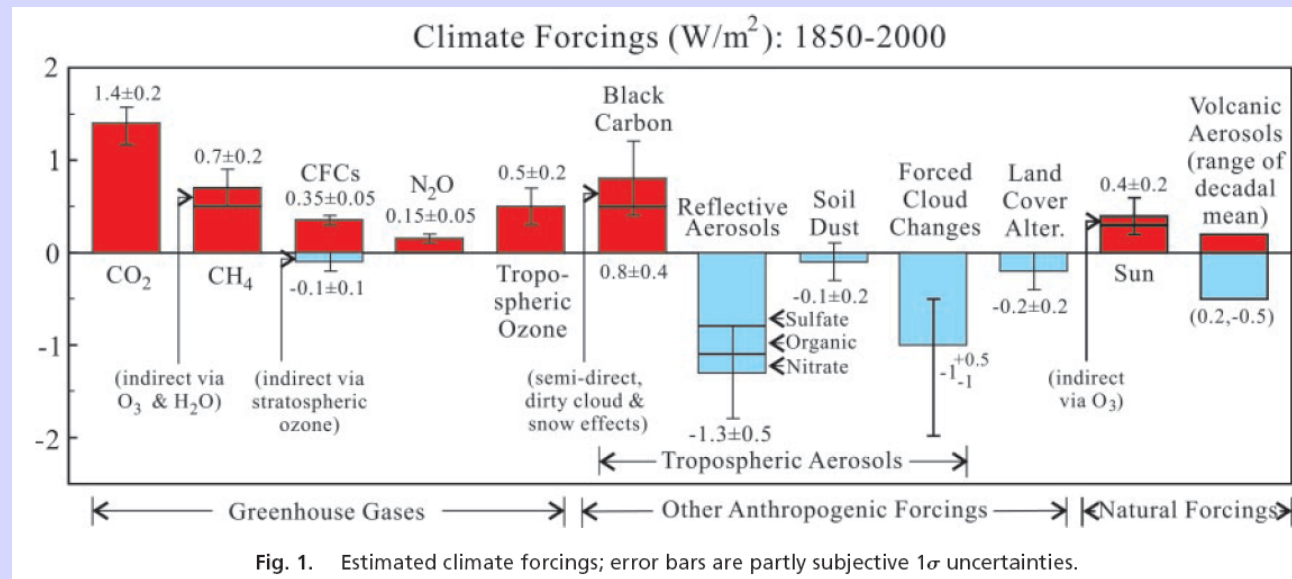
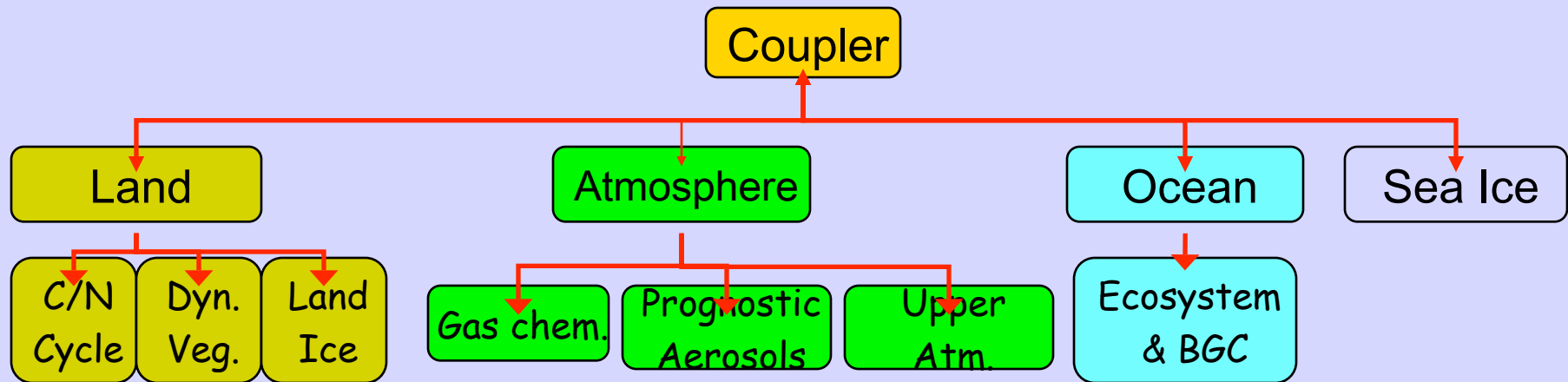
# Why does the CCSM need a land ice model?

- There is the obvious answer that land ice melting contributes to the local and global sea level rise.
- There have been an UNCOUNTABLE NUMBER of North Atlantic hosing experiments done with climate models during the last decade, using much computer time.
- EXTREMELY FEW of these have used a realistic input distribution of the fresh water in space and time.
- A good land ice model for Greenland would allow the CCSM to simulate this aspect of climate change well.

# Expected Configuration of CCSM4



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# What needs to be done in the next year ?

- The individual components of CCSM4 need to be finalized: the deadline is September 30.
- Then CCSM4 needs to be finalized; usually takes a few months, and 1870 control and 20<sup>th</sup> century runs made. Need high-res and low-res versions as well.
- Need to determine how best to initialize 20<sup>th</sup> and 21<sup>st</sup> century runs for the carbon cycle, especially the ocean.
- Need to get much more experience with short-term simulations – do we have the correct format, what difference does initializing the ocean make, etc ?

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